DPM-3/SST

SERIAL COMMUNICATION MANUAL
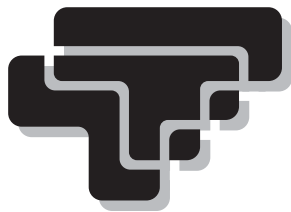
Transducer
Techniques®

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FOR TECHNICAL SUPPORT, CALL

(800) 344-3965 / FAX (951) 719-3900

REVISED 11/2019

2. INTRODUCTION, CUSTOM ASCII SERIAL PROTOCOL

The Custom ASCII Protocol is a simple serial communications protocol which is optimized for use with our programmable DPM-3 digital panel meters and SST transmitter / signal conditioners.

DPM-3 digital panel meters accept an optional serial communications plug-in board, which can be any of the following:

- RS232 board
- RS485 board with dual RJ11 jacks.
- RS485 board with dual RJ45 jacks
- USB board
- USB-to-RS485 converter board

Our two RS485 meter boards use the same circuitry and support the same serial protocols, differing only in the choice of connectors. Dual RJ11 jacks can be daisy-chained using readily available, straight-through 6-wire data cables (not 4-wire telephone cables or crossover cables). Dual RJ45 jacks are available for use with Modbus, as recommended in the Modbus Specification. With either board, the two jacks are wired in parallel to allow daisy chaining of meters with no need for a hub. External repeaters can increase the number of meters addressable with the Modbus protocol.

Our USB-to-RS485 converter board allows the host DPM-3 meter to function as a normal meter. It provides a USB port for connection to a host PC and an RJ11 jack for connection to an RS485 bus with up to 31 DPM-3 meters. These should be equipped with RS485 board with RJ11 connectors for daisy chaining using 6-wire data cables.

Our SST DIN-rail transmitters come standard with an isolated communication port, which can be jumpered for RS232, half duplex RS485, or RS485. Serial communications are in addition to a scalable 4-20 mA output and dual relays, which are standard.

The Modbus Protocol, described in a different manual, is a software-selectable alternative to the Custom ASCII Protocol. It is fully compliant with Modbus over Serial Line Specification V1.0 (2002). It is an industry standard which allows devices by different manufacturers to be digitally addressed on the same network. However, it is more complex than the Custom ASCII Protocol and is only recommended when Modbus compatibility is required.

USB connection of multiple meters to a PC can be via a USB hub or up to 5 hubs in series. Each USB connection is then automatically assigned a virtual com port number, which can be addressed via software. The USB standard specifies the maximum length of a USB cable as 5 meters (16 ft).
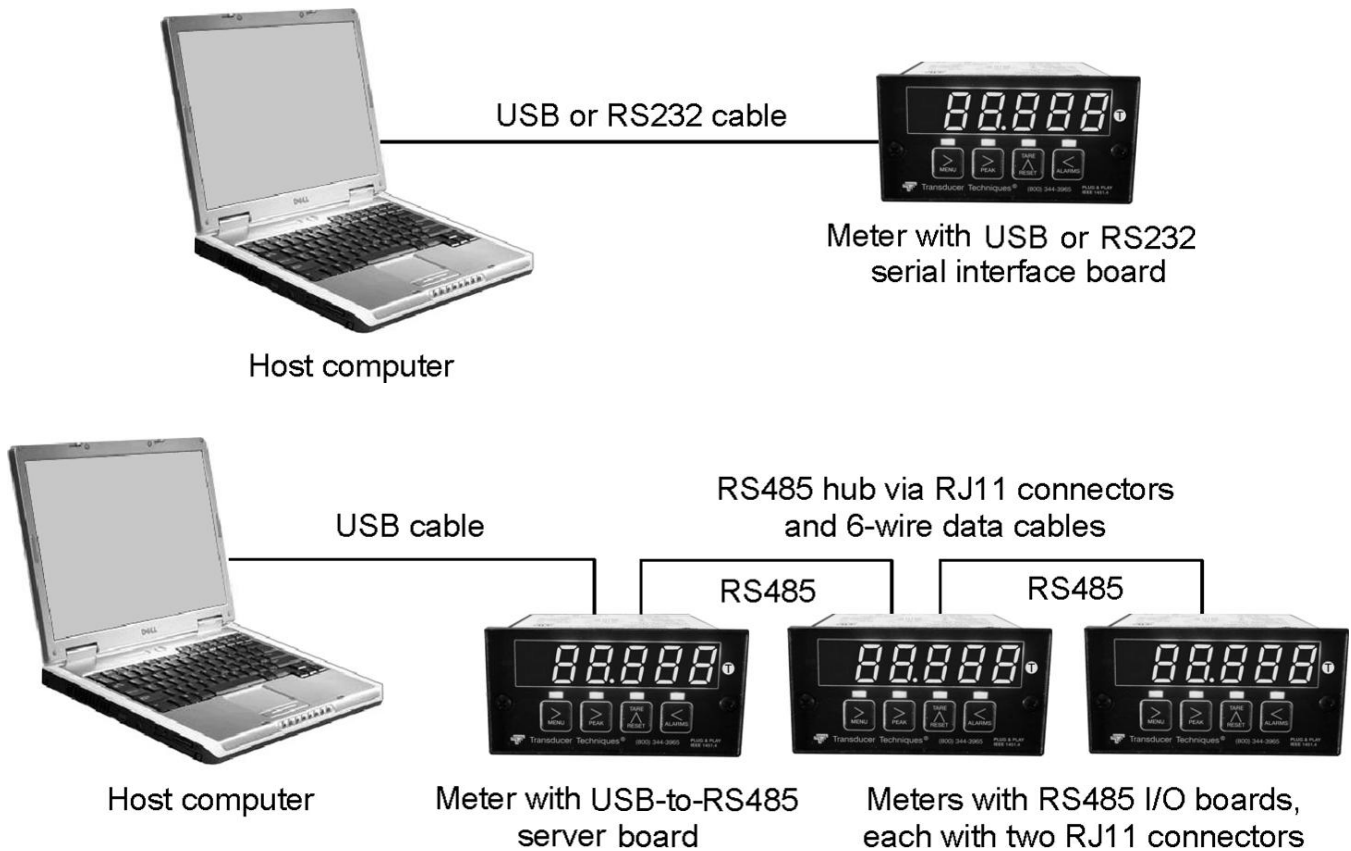
A better way to connect multiple meters to a PC USB port is to install an isolating USB-to-RS485 converter board in the first meter and to daisy chain multiple meters each with an RS485 board. Use a standard USB cable, Male Type A to Male Type B, to connect the PC to the server meter. The RJ11 output of each RS485 meter can then be connected to the next meter via a 6-conductor straight-through data cable. Up to 30 additional meters may be daisy chained and be addressed using the Custom ASCII Protocol.
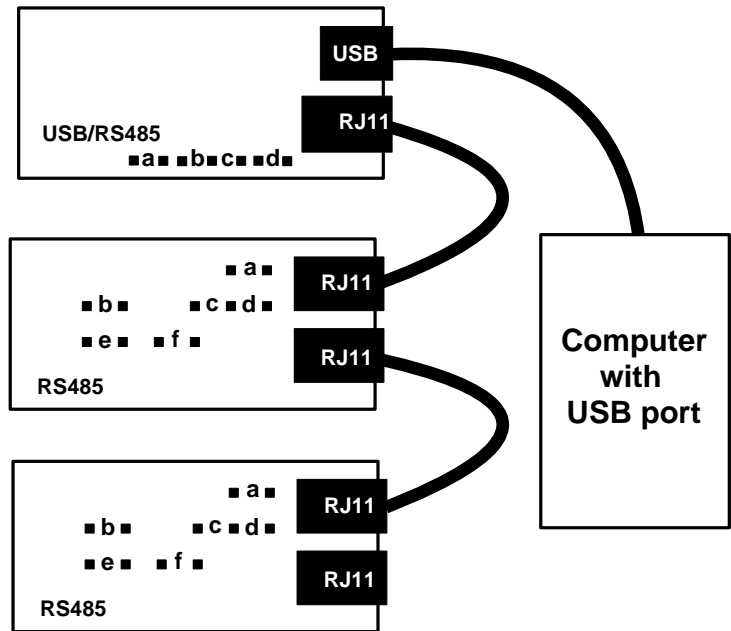
To load the USB driver, connect the meter with a USB board to the computer, which will display "Found new Hardware." Insert our USB installation CD and follow the instructions. When the installation is complete, use Windows Device Manager to determine the Com port number. To get to Device Manger, go to Control Panel, click on System on the Hardware tab, and then on Device Manager. Go down the device list and click on Ports (COM & LPT) and USB serial port (com #). Note the com port # for use with communications to your meter, then exit the Control Panel. If you need to change this number, right-click on USB serial port (com #), then click on Properties, Port Settings, and Advanced. Change the port to the desired number and click OK, then exit Control Panel.

3. SERIAL CONNECTION EXAMPLES

USB or RS232 cable

Meter with USB or RS232 serial interface board

Host computer

USB cable

RS485 hub via RJ11 connectors and 6-wire data cables

RS485   RS485

Host computer

Meter with USB-to-RS485 server board

Meters with RS485 I/O boards, each with two RJ11 connectors

4. JUMPER SETTINGS & FIELD WIRING

1. SAFETY WARNINGS

DPM-3 digital panel meters and SST transmitters may be powered with AC (mains) from 85-264 Vac or 90-300 Vdc with standard high voltage power, or 12-34V ac or 10-48 Vdc with the low voltage power supply option. To avoid the possibility of electrical shock or damaging short circuits, always unplug the device before opening the case. Please refer to the respective device manuals for full safety information and instruction on how to open the case. Signal wiring changes external to the case can be made safely while the units are under power.

2. JUMPERS ON SERIAL METER BOARDS

USB Board

No jumpers needed.

RS232 Board

e - Normal operation.
f - Slave display to RS232 from another meter.
g - Pull-up resistor on RTS line.
Note: Board is shipped with jumpers **e** and **g** installed
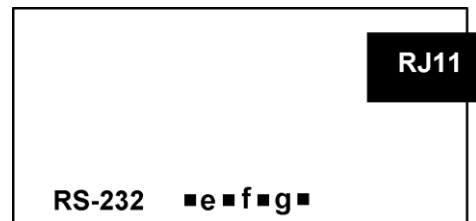
RS485-Modbus Board, Full Duplex Operation

b & e - Bias jumpers should be installed on 1 board.
a & d - Installed on last meter in long cable run.

RS485-Modbus Board, Half Duplex Operation

b & e - bias jumpers installed on 1 board.
c & f - installed for half duplex operation.
a - installed on last meter in line with long cable runs.

Note: Board is shipped with no jumpers installed.
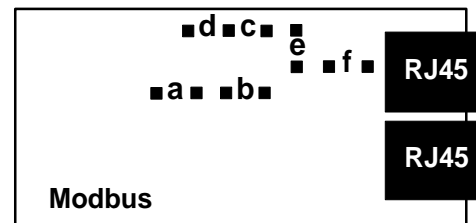
RS485 Board, Full Duplex Operation

b & d - Installed on last meter in long cable run.

RS485 Board, Half Duplex Operation

a & c - Installed for half duplex operation.
d - Installed on last meter in line with long cable runs.
Note: Board is shipped with no jumpers installed.
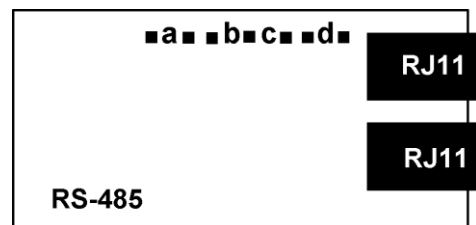
USB-to-RS485 Converter Board

Full Duplex Operation

No jumpers for short cable runs.
Add **b & d** for long cable runs.

Half Duplex Operation

a & c - Installed for half duplex operation.
d - Installed on last meter in line with long cable runs.

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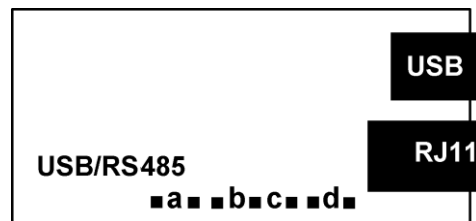
3. CONNECTOR WIRING, SERIAL BOARD TO COMPUTER

RS232 INTERFACE   Computer

N/C	6		
ISO GND	5		GND
RX	4		TX
TX	3		RX
RTS	2		RX
N/C	1		RTS
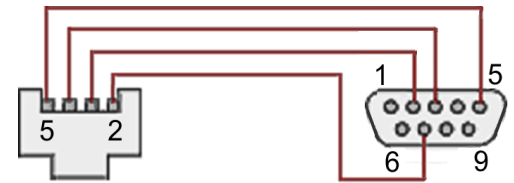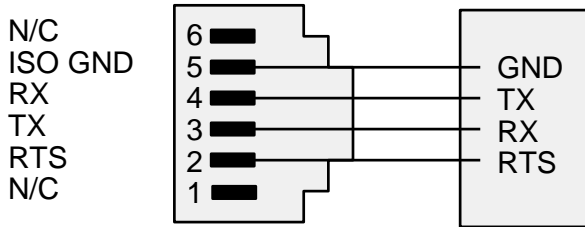
RJ11-to-DB9 RS232 cable with rear
view of DB9 connector to PC

RS485 INTERFACE - FULL DUPLEX

ISO GND	6		GND
BRX	5		BTX
ARX	4		ATX
ATX	3		ARX
BTX	2		BRX
ISO GND	1		GND
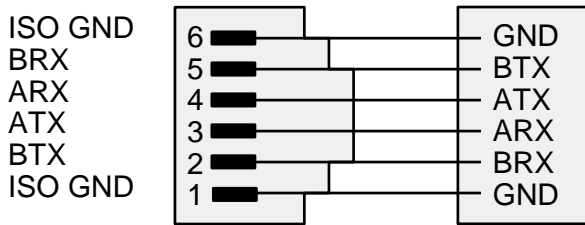
RS485 INTERFACE - HALF DUPLEX

ISO GND	6		GND
	5		
	4		
ATX / ARX	3		ATX / ARX
BTX / BRX	2		BTX / BRX
ISO GND	1		GND
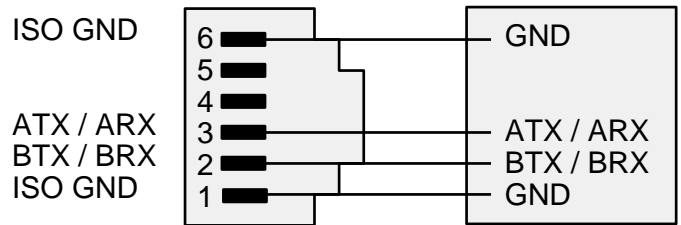
RS485-MODBUS - FULL DUPLEX

(A') RXD0 -	1		TXD0
(B') RXD1 +	2		TXD1
	3		
(B) TXD1 *	4		RXD1
(A) TXD0 -	5		RXD0
	6		
	7		
ISO GND	8		GND
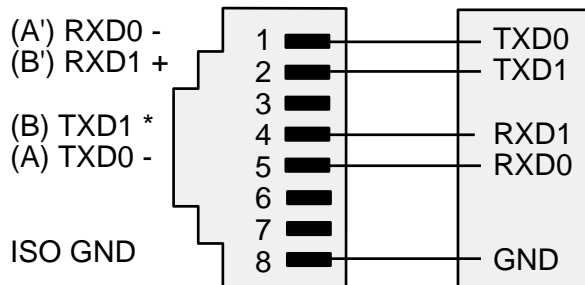
RS485-MODBUS - HALF DUPLEX

	1		
	2		
	3		
(B) TX / RXD1	4		(B) TX/RXD1
(A) TX / RXD0	5		(A) TX/RXD0
	6		
	7		
ISO GND	8		GND
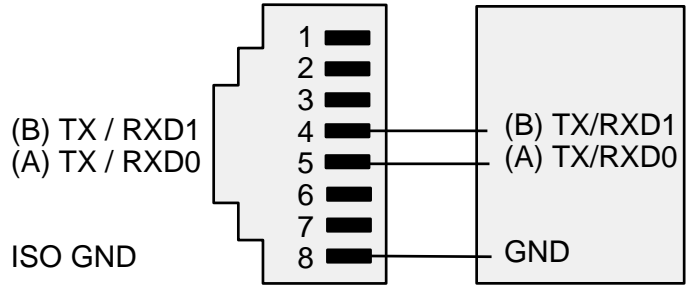
4. TRANSMITTER CONNECTOR WIRING

P6 Signal input & excitation output

Load cell signal conditioner board

Please see next page for wiring detail

1
2
3
4
5
6

Analog out - **1**
Analog out + **2**

P4 Analog output

AL2 **1**
AL2 **2**
AL1 **3**
AL1 **4**

P3 Solid state relays

P2 Serial data I/O

		RS485	RS232
	6	N/C	TX
	5	ARX	RX
	4	ATX	NC
	3	GND	GND
	2	BRX	GND
	1	BTX	N/C

P1 Power input

	3	Power GND
	2	AC neutral or -DC
	1	AC high or +DC

6 TX
5 RX
4 NC
3 GND
2 BRX
1 N/C

DB9 connector to PC (rear view)

Transmitter

RS232 wiring

6 N/C
5 ARX —— ATX
4 ATX —— ARX
3 GND —— GND
2 BRX —— BTX
1 BTX —— BRX

Transmitter   Master

RS485 wiring, full duplcx

6 N/C
5 ARX / ATX —— ATX / ARX
4 N/C
3 GND —— GND
2 BRX / BTX —— BTX / BRX
1 N/C

Transmitter   Master

RS485 wiring, half duplex
with internal jumpers.

6 N/C
5 ARX —— ATX / ARX
4 ATX
3 GND —— GND
2 BRX —— BTX / BRX
1 BTX

Transmitter   Master
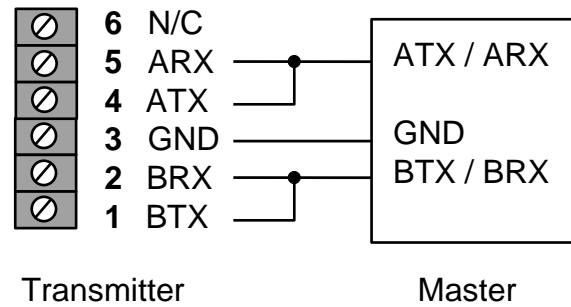
RS485 wiring, half duplex
with external jumpers.

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4. TRANSMITTER JUMPER SETTINGS
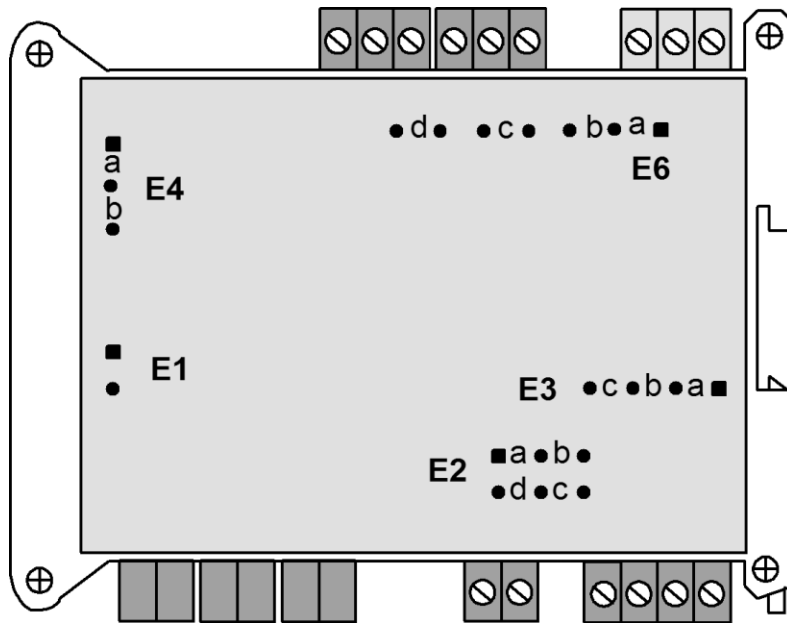
Serial Signal	Duplex	Jumpers	Termination Resistor*
RS485	Full	None	E6 a = Transmit E6 c = Receive
	Half	E6 b + d**	E6 c
RS232	Full	None	None

*   The termination resistor jumper settings should only be selected if the transmitter is the last device on an RS485 line longer than 200 feet (60 m).

**   Or jumper external BTX to BRX and ATX to ARX (same effect as internal jumpers).

To reset communications to 9600 baud, command mode, Custom ASCII protocol, and Address 1, place a jumper at E1, power up the transmitter, and then remove the jumper.

Analog Output	Jumpers
Current	E2 a + d
Voltage	E2 b + c

Excitation Output*	Jumpers
10V, 120 mA	E3 a + c; E4 b

*   Attempting to draw more than the rated current will shut down the output.

5. INSTRUMENT SETUP SOFTWARE

OVERVIEW

DPM-3 digital panel meters and SST transmitters are easily programmed via their serial port using Windows-based *Instrument Setup (IS)* software, which can be downloaded at no charge from www.transducertechniques.com/online-manuals.aspx. This software provides a graphical user interface. It allows uploading, editing, downloading and saving of setup data, execution of commands under computer control, listing, plotting and graphing of data, and computer prompted calibration. The DPM-3 can also be programmed via its 4-key front panel, as explained in the DPM-3 Operator Manual.

GETTING STARTED WITH INSTRUMENT SETUP SOFTWARE

As a first step, temporarily set User Account Control (UAC) of Windows to "Never notify" so that installation of *SSI Instrument Setup* can create directories. Use Google for instructions on how to change UAC settings for your version of Windows. Following installation of SSI Instrument Setup, return UAC to its previous setting.

To install IS software, download the file *DPM-3-IS.exe* from our website, double-click on the file name to extract three files, double-click *on setup.exe*, and follow the prompts. To launch IS software, press *Start => Programs => IS3 => IS3 Instrument Setup*. Establish communications by selecting matching settings between the instrument and PC, and click on *Establish*. Once communications have been established, click on *Main Menu*.

The best way to learn IS software is to experiment with it. From the Main Menu, click on *Get Setup* to retrieve (or get) the existing setup data from your device. Click on *View => Setup* to bring up screens which allow you to edit the setup file using pull-down menus and other selection tools. You can save your file to disk by clicking on *File => Save Setup*. You can download (or put) your edited file into the device by clicking on *Put Setup*. Programmable items will only be displayed if the appropriate hardware has been detected, such as the dual relay option for meters. Pressing the *F1* key at any time will bring up detailed help information.

An analog output is defined in two steps. The input to the device is first scaled to a digital reading in engineering units, and this reading is then scaled to the analog output. The digital reading is also used for setpoint control and can be transmitted as serial data.

ADDITIONAL FEATURES

- **The Commands pull-down menu** allows you to execute certain functions by using your computer mouse. The *Commands* pull-down menu will be grayed out unless a *Get Setup* has been executed.

- **The Readings pull-down menu** provides three formats to display input data on your PC monitor. In all formats, use the *Pause* and *Continue* buttons to control the timing of data collection, then press *Print* for a hardcopy on your PC printer. **List** presents the latest digital readings in a 20-row by 10-column table. **Plot** generates a plot of digital readings vs. time in seconds, like an oscilloscope. **Graph** generates a histogram, where the horizontal axis is the reading and the vertical axis is the number of readings.

6. FRONT PANEL METER SETUP, SERIAL COMMUNICATIONS

MENU Press Menu Select Key	**PEAK** Press Digit Select Key	**RESET** Press Value Select Key	
SEr 1 Press ➡ until *Ser 1* is displayed. Fixed Parameters: - No parity - 8 data bits - 1 stop bit	**__000** Output filtering	**0** Send unfiltered signal **1** Send filtered signal	
	__000 Baud rate	**0** 300 baud **1** 600 baud **2** 1200 baud **3** 2400 baud **4** 4800 baud **5** 9600 baud **6** 19200 baud	
	__000 Output update rate, Continuous Data Output Mode.	<table><tr><td></td><td>60 Hz</td><td>50 Hz</td></tr><tr><td>0</td><td>0.017 sec</td><td>0.020 sec</td></tr><tr><td>1</td><td>0.28 sec</td><td>0.34 sec</td></tr><tr><td>2</td><td>0.57 sec</td><td>0.68 sec</td></tr><tr><td>3</td><td>1.1 sec</td><td>1.4 sec</td></tr><tr><td>4</td><td>2.3 sec</td><td>2.7 sec</td></tr><tr><td>5</td><td>4.5 sec</td><td>5.4 sec</td></tr><tr><td>6</td><td>9.1 sec</td><td>10.9 sec</td></tr><tr><td>7</td><td>18.1 sec</td><td>21.8 sec</td></tr><tr><td>8</td><td>36.6 sec</td><td>43.5 sec</td></tr><tr><td>9</td><td>72.5 sec</td><td>86.7 sec</td></tr></table>	
SEr 2 Serial Setup 2	**_0000** Line feed	**0** No \<LF> following \<CR> **1** \<LF> following \<CR>	
	_0000 Alarm data with readings	**0** No alarm data with reading **1** Alarm data with reading	
	_0000 Control of data output	**0** Continuous data output **1** Data output on ASCII command only	
	_0000 Meter address	Select **1** thru **F** for addresses 1 thru 15. Select **0.** thru **F.** (with decimal point) for addresses 16 thru 31.	

MENU Press Menu Select Key	▶ Press Digit Select Key	▲ Press Value Select Key
SEr 3 Serial Setup 3	**0**0000 RS485 half or full duplex	**0** Full duplex **1** Half duplex
	00**0**00 Special start & stop char. (entered using Instrument Setup Software)	**0** * Start, <CR> Stop characters **1** Special Start & Stop characters
	00**0**00 RTS mode (for RS232)	**0** Normal non-latching RTS **1** Single transmission, latching RTS
	000**0**0 Termination characters	**0** Only at end of all items **1** At end of each item
	0000**0** Data sent, digital panel meter only	**0** Reading **1** Peak **2** Valley **3** Reading + Peak **4** Reading + Valley **5** Reading + Peak + Valley
	0000**0** Data sent, scale meter only	**0** Net + Gross **1** Net only **2** Gross only **3** Peak only (Net or Gross) **4** Net + Gross + Peak **5** Valley only
SEr 4 Serial Setup 4	__**0**00 Modbus ASCII gap timeout*	**0** 1 sec **2** 5 sec **1** 3 sec **3** 10 sec
	__0**0**0 Serial protocol	**0** Custom ASCII **1** Modbus RTU **2** Modbus ASCII
	__00**0** Parity	**0** None **1** Odd (Modbus only) **2** Even (Modbus only)
Addr Modbus Address*	__**0**00 __0**0**0 __00**0** Select digit to flash.	__**158** Select **0** through **9** for flashing digit. Address range is 1 to 247.

7. CUSTOM ASCII COMMUNICATION PROTOCOL

7.1 SERIAL COMMUNICATION FORMAT

The Custom ASCII serial communication format for RS232, RS485 and USB is the following:

Duplex .... Full duplex for RS232 & RS485. Half duplex selectable for RS485.
Baud Rate .... 300, 600, 1200, 2400, 4800, 9600, 19200 selectable by front panel Menu item "Ser 1", Sub-menu item "Digit 4" for DPM, "Digit 5" for counter.
Parity .... None
Word length .... 8 data bits
Stop bit 1

7.2 MEASUREMENT DATA FORMAT

The basic measurement data format consists of 8 ASCII characters for the DPM, such as <SP>999.99 <CR> and 9 characters for the counter, such as <SP> 9999.99<CR>, where <SP> is the space character and <CR> is the carriage return character. The first character is always a space character or minus sign. A decimal point is always furnished, even when it follows the last digit.

Adding a Line Feed Character to the Basic Format

Printers and other devices that receive the measurement data may require a line feed character <LF> following the <CR>. The line feed character may be selected in "Ser 2".

Adding a Coded Data Character to the Basic Format

It is possible to add a coded character from A to h to the data string according to the table to the right to indicate the alarm and overload status of the device. If used, this character precedes the <CR>, so it is the last printable character in the string. With the optional <LF> and coded character selected, the data string will consist of 10 characters for the DPM: <SP>999.99A<CR><LF>.

For example, a coded character "G" indicates that Alarm 2 only is set and that the DPM is in overload condition. This information is useful when data is supplied to a computer for listing and analysis, or when data is supplied to a Remote Display in a Master-Slave configuration.

Alarm # 4 3 2 1				Alarm with No Overload	Alarm with Overload
0	0	0	0	A	E
0	0	0	1	B	F
0	0	1	0	C	G
0	0	1	1	D	H
0	1	0	0	I	M
0	1	0	1	J	N
0	1	1	0	K	O
0	1	1	1	L	P
1	0	0	0	Q	U
1	0	0	1	R	V
1	0	1	0	S	W
1	0	1	1	T	X
1	1	0	0	a	e
1	1	0	1	b	f
1	1	1	0	c	g
1	1	1	1	d	h

Values are transmitted in a continuous string with no space between them. If the 5th digit in "Ser 3" is set to 1, the termination characters of <CR> and optional <LF> appear after each value. If the 5th digit is et to 0, the termination characters appear only once at the end of the string. In either case, if included, the coded character appears at the end of the last value only.

7.3   NETWORK CONFIGURATIONS

The meters and transmitters can operate in a point-to-point mode using RS-232 or RS-485, or in a multi-point mode using RS-485.

The point-to-point mode is a direct connection between a computer (or other digital device) and the meter or transmitter.

The multi-point mode is a connection from a host computer to a multiplicity of meters or transmitters bused together with their inputs and outputs connected in parallel. For long cable runs, the first and last devices should have a termination resistor installed. It is necessary to set up each device on the bus with a different address from 1 to 31. To command a particular device, its address is used in conjunction with the command, and only that device responds. The outputs of all of the devices on the bus are set to a high impedance state, except the device being addressed. The device addresses range from 1 to 31. A special address to which all meters respond is 0 and should not be used in the multi-point mode. Addressing of meters can be set in "Ser 2".

A device operating in a point-to-point mode must also be addressed. Although any address will suffice, it is suggested address = 1 be selected as a standard for the point-to-point mode.

7.4   OPERATING MODES

The meters and transmitters can operate in a Continuous Mode or a Command Mode.

In the Continuous Mode, measurements are continuously transmitted by the meter in a standard data format. Please see the next manual section.

In the Command Mode, the meter does not send any data automatically, but responds to commands received from a host computer. Please see the manual section following the Continuous Mode.

8. CONTINUOUS MODE

8.1 OVERVIEW

In the Continuous Operating Mode, measurements are continuously transmitted by the meter or transmitter in a standard data format using printable ASCII characters at a user-selectable rate ranging from 50 or 60 Hz line frequency down to one measurement every 72 seconds. This data may be received by a remote display at a distant location, by a printer for data logging purposes, or by a host computer for data analysis or system control.

Both hardware (RTS) and software (XON/XOFF) handshaking are available for RS232, but neither is available for RS485.

The transmission rate of the measurement data can be selected in "Ser 1". The meter conversion rate equals the AC power frequency (50 or 60 Hz). Any baud rate may be used, but if less than the minimum baud rate in the table, the transmission rate will decrease accordingly.

Output Rate	Data Output Rate	Minimum Baud Rate		
"Ser 1" Setting	50 Hz / 60 Hz	1 Item Sent	2 Items Sent	3 Items Sent
0	0.021s / .018 s	9600	9600	19200
1	0.34 s / 0.28 s	600	600 / 1200	1200
2	0.68 s / 0.57 s	300	300 / 600	600
3	1.4 s / 1.1 s	300	300	300
4	2.7 s / 2.3 s	300	300	300
5	5.4 s / 4.5 s	300	300	300
6	10.9 s / 9.1 s	300	300	300
7	21.8 s / 18.1 s	300	300	300
8	43.5 s / 36.3 s	300	300	300
9	86.7s / 72.3 s	300	300	300

8.2 RTS CONTROL

RTS control does not apply to transmitter, where the RTS line is always held high, nor to RS485. DPMs and counter / timers have two RS232 RTS modes: unlatched and latched. These modes are selected in "Ser3".

In the unlatched mode, the measurement transmission is enabled by a high RTS level and is disabled by a low RTS level. When disabled, any character being sent is completed. When enabled, any characters remaining in the data format are transmitted before the next measurement transmission. The computer, when its receive buffer is nearly full, takes the RTS line low to halt data transmission. When its receive buffer has emptied, it takes the RTS line high to

enable more data transmissions. Some measurements could be missed in the process. **In the latched mode,** the RTS input is polled every 3.3 ms. When a high level is detected, RTS is latched true, even though the RTS line goes low immediately. At the end of each calculation, the latched RTS value is checked. If it is true, a complete measurement transmission (from 1 to 4 values) is made without interruption, regardless of the state of the RTS line during that time. At the end of the complete transmission, the latched RTS value is reset false, even though the RTS line may be high at that instant. The RTS latch does not go true again until the RTS line is first returned to a low level after the completion of the transmission and then is taken high again. Latched control provides "print command" operation by sending a transmission for each RTS pulse. If a second pulse occurs during the transmission, it is not recognized.

8.3 XON / XOFF CONTROL

Applicable to RS232, not RS485. A measurement transmission is enabled by the receipt of an ASCII XON character. It is disabled by the receipt of an ASCII XOFF character.

9. COMMAND MODE

9.1 OVERVIEW

In the Command Mode, the device does not send any data automatically, but responds to commands received from a host computer. These commands can be:

- To transmit the latest, peak, or valley measurement.
- To reset the meter completely or just the peak and valley values and latched alarms.
- To display a value sent from the computer.
- To transmit present setup parameters.
- To receive new setup parameters.
- To monitor or alter data in selected memory locations of the meter.

The selection of either the Continuous mode or the Command Mode can be made from the front panel Menu selection "Ser 2". The meter will not respond to a command in the Continuous Mode, except the command "A1", which puts the meter into the Command Mode.

9.2 COMMAND MODE FORMAT

The minimum format is 4 characters. Example: *5A1

CHAR 1 - COMMAND IDENTIFIER

All commands begin with "*" followed by the meter address, then a command letter followed by a sub-command number or letter. Additional characters may be appended. All commands terminate with <CR> (<LF> ignored).

Char #	Character	Description
1	*	Command Identifier (Recognition Character)
2	0-V	Device Address (0 addresses all devices, 1-V specific)
3	A-Z	Command Function
4	0-U	Sub-command (or # Bytes or Words of data being transferred)

CHAR 2 - ADDRESS CODES

The next table is the Serial Communication Address Codes following the "*" for each meter address number. Also shown is the corresponding character that is set in menu item "SER 2".

Meter #	Meter SER 2 Digit 5(6)	Serial Comm Address Code	Meter #	Meter SER 2 Digit 5(6)	Serial Comm Address Code
1	1	1	16	0.	G
2	2	2	17	1.	H
3	3	3	18	2.	I
4	4	4	19	3.	J
5	5	5	20	4.	K
6	6	6	21	5.	L
7	7	7	22	6.	M
8	8	8	23	7.	N
9	9	9	24	8.	O
10	A	A	25	9.	P
11	B	B	26	A.	Q
12	C	C	27	B.	R
13	D	D	28	C.	S
14	E	E	29	D.	T
15	F	F	30	E.	U
			31	F.	V

CHARS 3 & 4 - COMMANDS AND SUBCOMMANDS

The examples below use a default address of 1 following the "*". Substitute the desired address from the above table of Serial Comm Address Codes. All command sequences shown must terminate with <CR>, followed by an optional <LF>.

COMMUNICATIONS MODE

Continuous mode   *1A0
Command mode   *1A1

REQUEST VALUES

Get reading**   *1B1
Peak reading   *1B2
Valley reading   *1B3

** The meter transmits the value or values selected in Ser 3.

RESET FUNCTIONS

Cold reset   *1C0   Reads NVMEM into RAM locations after RAM is zeroed.
Latched alarms reset   *1C2
Peak value reset   *1C3
Remote display reset   *1C4
External Input B true   *1C5
External Input B false   *1C6

External Input A true	*1C7
External Input A false	*1C8
Valley reset	*1C9
Tare function	*1CA
Tare reset	*1CB

9.3 READING AND WRITING TO RAM AND NONVOLATILE MEMORY

CHARACTERS 1, 2

The Recognition character and Meter Address Code are the same as shown in previous table.

CHARACTER 3: Command character:

G	Read bytes from RAM Memory
F	Write bytes to RAM Memory
R	Read bytes from Upper RAM Memory
Q	Write bytes to Upper RAM Memory
X	Read words from Non-Volatile Memory
W	Write words to Non-Volatile Memory

CHARACTER 4: Number of bytes (G, F, R, Q) or words (X, W)

Code #			
1 = 1	9 = 9	H = 17	P = 25
2 = 2	A = 10	I = 18	Q = 26
3 = 3	B = 11	J = 19	R = 27
4 = 4	C = 12	K = 20	S = 28
5 = 5	D = 13	L = 21	T = 29
6 = 6	E = 14	M = 22	U = 30
7 = 7	F = 15	N = 23	
8 = 8	G = 16	O = 24	

CHARACTERS 5, 6

See tables for the RAM MEMORY ADDRESSES and NONVOLATILE MEMORY ADDRESSES with their respective data definitions.

CHARACTERS 7 & UP: Data to be written (F, Q, W).

READING AND WRITING RAM MEMORY DATA

RAM memory data is read and written as a continuous string of bytes consisting of 2 hex characters (0-9,A-F) per byte. Included in the command are the total number of bytes to be transferred and the most significant address in RAM of the continuous string of bytes. The format is:

Read lower RAM data   *1Gnaa
Write lower RAM data   *1Fnaa<data>
Read upper RAM data   *1Rnaa
Write upper RAM data   *1Qnaa<data>
where: n   is the number of bytes to be read or written.
      aa   is the most significant address in RAM of the bytes to be read or written.
   <data>   is n bytes of 2 hex characters per byte in order from the most to the least significant byte.

The number of bytes n consists of a single code character representing values from 1 to 30 as shown above under CHARACTER 4. The most significant address aa consists of 2 hex characters as shown below under RAM MEMORY ADDRESSES AND DATA DEFINITIONS.

READING AND WRITING NONVOLATILE MEMORY DATA

Nonvolatile data is read and written as a continuous string of words consisting of 2 bytes or 4 hex characters (0-9,A-F) per word. Included in the command is the total number of words to be transferred and the most significant address in nonvolatile memory of the continuous string of words. The format is:

Read nonvolatile memory data   *1Xnaa   (Meter reset occurs after all data is read.)
Write non-volatile memory data   *1Wnaa <data> (Meter reset occurs after data is written.)
where: n   is the number of words to be read or written.
     aa   is the most significant address in nonvolatile memory of the words to be read or written.
   <data> is n words of 2 bytes or 4 hex characters per word in order from the most to the least significant address

The coded number of words n consists of a single character representing values from 1 to 30 as shown under CHARACTER 4. The most significant address aa consists of 2 hex characters as shown under NONVOLATILE MEMORY ADDRESSES.

10.1 DPM 1-BYTE RAM MEMORY DATA

(L) = Lower memory, (U) = Upper memory.

The bit assignments below constitute an 8-bit binary number, which needs to be converted to Hex using a program such a Scientific Calculator under MS Windows Accessories. To change an Item in DPM RAM Memory, write the converted Hex value to the Hex Address shown in the left column. To change an Item in Nonvolatile Memory, go to table 10.4, read the existing two-byte word (MS byte and LS byte) from the DPM for the Hex Address which includes the Item to be changed, edit the MS or LS byte as appropriate, and write the edited word back to the Hex Address. Be careful not to overwrite the Sig Cond Type LS byte under Hex Address 15.

Hex Address	Item Name	Bit Assignment
DE (L)	Configuration	Bit 7 6 5 4 3 2 1 0
		0 Linear data
		1 Custom curve (Extended DPM)
		0 Spare
		0 No Auto-Tare
		1 Auto-Tare
		0 0 Peak button displays Peak
		0 1 Peak button displays Valley
		1 0 Peak b. displays Peak then Valley
		1 1 Peak button tares the meter
		0 0 0 Not rate
		0 0 1 Rate x 0.1
		0 1 0 Rate x 1
		0 1 1 Rate x 10
		1 0 0 Rate x 100
		1 0 1 Rate x 1000
		1 1 0 Rate x 10,000
BF (L)	Analog Setup	Bit 7 6 5 4 3 2 1 0
		0 Analog output unfiltered
		1 Analog output filtered
		0 0 0-20 mA current output
		0 1 0-10V voltage output
		1 0 4-20 mA current output
		1 1 -10V to +10V output

Register 69 (L) — Serial Cnfg3

Address	Name	Bit 7	6	5	4	3	2	1	0	Description
69 (L)	Serial Cnfg3						0	0	0	Send Reading
							0	0	1	Send Peak
							0	1	0	Send Valley
							0	1	1	Send Reading + Peak
							1	0	0	Send Reading + Valley
							1	0	1	Send Reading + Peak + Valley
						0				<CR> or <CR><LF> at end of all Items
						1				<CR> or <CR><LF> at end of each Item (if no Alarm character)
					0					Non-latching RTS
					1					Latching RTS
				0						Normal continuous TX
				1						Special Start & Stop characters
			0							Full duplex
			1							Half duplex

Register 35 (L) — Decimal Point

Address	Name	Byte values		Display
35 (L)	Decimal Point	01	Byte values in hex	XXXXX.
		02	(2 hex characters/byte)	XXXX.X
		03		XXX.XX
		04		XX.XXX
		05		X.XXXX
		06		.XXXXX

Register 34 (L) — Lockout2 (0 = unlocked, 1 = locked)

Address	Name	Bit 7	6	5	4	3	2	1	0	Menu item & front panel lockout
34 (L)	Lockout2								1	Serial configuration
								1		Analog output scaling
							1			Alarm setpoint programming
						1				Alarm setup
					1					Front panel DPM reset
				1						Front panel Peak & Alarm reset
			1							View alarm setpoints
		1								View Peak value & Tare function

Register 33 (L) — Lockout1 (0 = unlocked, 1 = locked)

Address	Name	Bit 7	6	5	4	3	2	1	0	Menu item & front panel lockout
33 (L)	Lockout1								1	Offset, Lo & Hi readings
								1		Scale, Lo In, Hi In
							1			Filter Setup
						1				Setup, Config & Decimal Point
					1					InPut Menu Item

		Bit 7	6	5	4	3	2	1	0	
32 (L)	Serial Cnfg2				X	X	X	X	X	Binary Custom ASCII addr. 0-31
				0						Continuous mode
				1						Command mode
			0							Alarm data not included with rdg.
			1							Alarm data included with rdg.
		0								No <LF> following <CR>
		1								<LF> following <CR>
31 (L)	Serial Cnfg1	Bit 7	6	5	4	3	2	1	0	Continuous Output Data Rate

Continuous Output Data Rate:

3	2	1	0	60 Hz	50 Hz
0	0	0	0	0.017s	0.02s
0	0	0	1	0.28	0.34
0	0	1	0	0.57	0.68
0	0	1	1	1.1	1.4
0	1	0	0	2.3	2.7
0	1	0	1	4.5	5.4
0	1	1	0	9.1	10.9
0	1	1	1	18.1	21.8
1	0	0	0	36.3	43.5
1	0	0	1	1:13	1:27
1	0	1	0	2:25	2:54
1	0	1	1	4:50	5:48
1	1	0	0	9:40	11:36
1	1	0	1	19:20	23:13
1	1	1	0	38:41	46:25
1	1	1	1	1:17:21	1:32:51

Bit 6	5	4	
0	0	0	300 baud
0	0	1	600 baud
0	1	0	1200 baud
0	1	1	2400 baud
1	0	0	4800 baud
1	0	1	9600 baud
1	1	0	19200 baud

Bit 7	
0	Send unfiltered value
1	Send filtered value

2F (L)	Filter	Bit 7	6	5	4	3	2	1	0		60 Hz	50 Hz
						0	0	0	0	Auto Filter		
						0	0	0	1	Batch (16 samples) filter		
										Time constant	60 Hz	50 Hz
						0	0	1	0	Moving average	0.07 s	0.085 s
						0	0	1	1	Moving average	0.14	0.17
						0	1	0	0	Moving average	0.28	0.34
						0	1	0	1	Moving average	0.57	0.68
						0	1	1	0	Moving average	1.13	1.36
						0	1	1	1	Moving average	2.27	2.72
						1	0	0	0	Moving average	4.53	5.44
						1	0	0	1	Moving average	9.06	10.88
						1	0	1	0	Unfiltered		
					0					Low adaptive threshold		
					1					High adaptive threshold		
				0						Display batch		
				1						Display filtered signal		
			0							Take peak of unfiltered signal		
			1							Take peak of filtered signal		
		0								Alarm from unfiltered signal		
		1								Alarm from filtered signal		

2D (L)	Setup	Bit 7	6	5	4	3	2	1	0	EXT IN 1	EXT IN 2	BOTH
						0	0	0	0	Mtr Reset	Mtr Hold	Mtr Reset
						0	0	0	1	Fct Reset	Rd Pk/Vl	Mtr Reset
						0	0	1	0	Mtr Hold	Rd Pk/Vl	Fct Reset
						0	0	1	1	Mtr Hold	Tare	Mtr Reset
						0	1	0	0	Rd Pk/Vl	Tare	Fct Reset
						0	1	0	1	Tare	Mtr Reset	Mtr Reset
						0	1	1	0	DP2	DP3	DP4
						0	1	1	1	DP3	DP4	DP5
						1	0	0	0	Fct Reset	Disp Blank	Mtr Reset
						1	0	0	1	Mtr Hold	Disp Blank	Mtr Reset
						1	0	1	0	Rd Pk/Vl	Disp Blank	Fct Reset
						1	0	1	1	Tare	Disp Blank	Mtr Reset
						1	1	0	0	Rd Valley	Read Peak	Fct Reset
						1	1	0	1	Tare	Tare Reset	Mtr Reset
				0	0					Scale using Scale & Offset method		
				0	1					Scale using Coordinates of 2 Points method		
				1	1					Scale using Reading Coordinates of 2 Points		
			0							60 Hz power		
			1							50 Hz power		

09 (U)	Setup1* * Cannot be written to RAM	Bit 7	6	5	4	3	2	1	0	
								0	0	4-1/2 digit display (0.1° temp.)
								0	1	Remote display
								1	0	4-1/2 digit count by 10 (0.01° t.)
								1	1	3-1/2 digit display (1° temp.)

0D (U)	Alarm Confg4	Bit 7	6	5	4	3	2	1	0	Alarm Trigger Delay	
										60 Hz	50Hz
							0	0	0	0.018 s	0.021 s
							0	0	1	0.035	0.043
							0	1	0	0.07	0.085
							0	1	1	0.14	0.17
							1	0	0	0.28	0.34
							1	0	1	0.56	0.68
							1	1	0	1.13	1.36
							1	1	1	2.27	2.72
				0	0	0				AI3 Band Dev, AI4 Band Dev	
				0	0	1				AI3 Hysteresis, AI4 Band Dev	
				0	1	0				AI3 Band Dev, AI4 Hysteresis	
				0	1	1				AI3 Hysteresis, AI4 Hysteresis	
				1	0	0				No deviation in menus or calc	

0C (U)	Alarm Confg3	Bit 7	6	5	4	3	2	1	0	
						0	0	0	0	AI3 Hi active, AI4 Hi active
						0	0	0	1	AI3 Lo active, AI4 Hi active
						0	0	1	0	AI3 Disabled, AI4 Hi active
						0	1	0	0	AI3 Hi active, AI4 Lo active
						0	1	0	1	AI3 Lo active, AI4 Lo active
						0	1	1	0	AI3 disabled, AI4 Lo active
						1	0	0	0	AI3 Hi active, AI4 disabled
						1	0	0	1	AI3 Lo active, AI4 disabled
						1	0	1	0	AI3 disabled, AI4 disabled
				0	0					AI3 non-latch, AI4 non-latch
				0	1					AI3 latch, AI4 non-latch
				1	0					AI3 non-latch, AI4 latch
				1	1					AI3 latch, AI4 latch
			0	0						Relay3 On when AI3 active, Relay4 On when AI4 active
			0	1						Relay3 Off when AI3 active, Relay4 On when AI4 active
			1	0						Relay3 On when AI3 active, Relay4 Off when AI4 active
			1	1						Relay3 Off when AI3 active, Relay4 Off when AI4 active

Addr	Name	Bit 7	6	5	4	3	2	1	0	Description
0B (U)	Alarm Confg2	Bit 7	6	5	4	3	2	1	0	Alarm Trigger Delay
										60 Hz 50Hz
							0	0	0	0.018s 0.021s
							0	0	1	0.035 0.043
							0	1	0	0.07 0.085
							0	1	1	0.14 0.17
							1	0	0	0.28 0.34
							1	0	1	0.56 0.68
							1	1	0	1.13 1.36
							1	1	1	2.27 2.72
				0	0	0				Al1 Band Dev, Al2 Band Dev
				0	0	1				Al1 Hysteresis, Al2 Band Dev
				0	1	0				Al1 Band Dev, Al2 Hysteresis
				0	1	1				Al1 Hysteresis, Al2 Hysteresis
				1	0	0				No deviation in menus or calc
0A (U)	Alarm Confg1	Bit 7	6	5	4	3	2	1	0	
						0	0	0	0	Al1 Hi active, Al2 Hi active
						0	0	0	1	Al1 Lo active, Al2 Hi active
						0	0	1	0	Al1 Disabled, Al2 Hi active
						0	1	0	0	Al1 Hi active, Al2 Lo active
						0	1	0	1	Al1 Lo active, Al2 Lo active
						0	1	1	0	Al1 disabled, Al2 Lo active
						1	0	0	0	Al1 Hi active, Al2 disabled
						1	0	0	1	Al1 Lo active, Al2 disabled
						1	0	1	0	Al1 disabled, Al2 disabled
				0	0					Al1 & Al2 non-latching
				0	1					Al1 latching, Al2 non-latching
				1	0					Al1 non-latching, Al2 latching
				1	1					Al1 & Al2 latching
			0	0						Relay1 On when Al1 active, Relay2 On when Al2 active
			0	1						Relay1 Off when Al1 active, Relay2 On when Al2 active
			1	0						Relay1 On when Al1 active, Relay2 Off when Al2 active
			1	1						Relay1 Off when Al1 active, Relay2 Off when Al2 active

00 (U)	Serial Cnfg4	Bit 7 6 5 4 3 2 1 0 Serial Protocol
		0 0 No Parity
		0 1 Odd Parity
		1 0 Even Parity
		0 0 Custom ASCII protocol (8 bits)
		0 1 Modbus RTU protocol (8 bits)
		1 0 Modbus ASCII protocol (7 bits)
		0 0 1 s Modbus ASCII gap timeout
		0 1 3 s Modbus ASCII gap timeout
		1 0 5 s Modbus ASCII gap timeout
		1 1 10 s Modbus ASCII gap timeout
35 (U)	Modbus Addr.	00 to FF — Modbus address 0-255 (in Hex format)

10.2 3-BYTE RAM MEMORY DATA

Format for all items except Scale Factor:

	MS byte	Mid byte	LS byte
	XX	XX	XX

Format for Scale Factor:

	*X	XX	XX

The 4-bit MS nibble "*" sets the polarity and decimal point according to the following table:

Positive	Negative	Decimal Point
1	9	XXXXX.
2	A	XXXX.X
3	B	XXX.XX
4	C	XX.XXX
5	D	X.XXXX
6	E	.XXXXX

Note: Hex values are 2's complement and absolute values.

10.3   HEX ADDRESSES

MS	Mid	LS	Description
A1 (L)	A0	9F	Analog high value
9E (L)	9D	9C	Analog low value
1B (U)	1A	19	Deviation, Alarm4
18 (U)	17	16	Deviation, Alarm3
9B (L)	9A	99	Deviation, Alarm2
98 (L)	97	96	Deviation, Alarm1
8F (L)	8E	8D	Offset value
8C (L)	8B	8A	Scale factor
15 (U)	14	13	Setpoint4
12 (U)	11	10	Setpoint3
89 (L)	88	87	Setpoint2
86 (L)	85	84	Setpoint1

10.4 DPM NONVOLATILE MEMORY ADDRESSES (2 bytes/address)

Hex Addr	MS Byte	LS Byte	Stored As
75	Setup1	Serial Confg3	Bits
74	Deviation4 Byte 3	Deviation4 Byte 2	Magnitude
73	Deviation4 Byte 1	Deviation3 Byte 3	Magnitude
72	Deviation3 Byte 2	Deviation3 Byte 1	Magnitude
71	Setpoint4 Byte 3	Setpoint4 Byte 2	2's Complement
70	Setpoint4 Byte 1	Setpoint Byte 3	2's Complement
6F	Setpoint3 Byte 2	Setpoint3 Byte 1	2's Complement
6E	Alarm Cnfg4	Alarm Confg 3	Bits
6D	Version (read only)	M Type (read only)	Byte
36	Tare Setup	Analog Type	Bits
35	Serial Cnfg4 (Bits)	Modbus Address (Byte)	
18	Deviation2 Byte 3	Deviation2 Byte 2	Magnitude
17	Deviation2 Byte 1	Deviation1 Byte 3	Magnitude
16	Deviation1 Byte 2	Deviation1 Byte 1	Magnitude
15	Configuration	Sig Cond Type (do not change)	Bits
14	Analog Setup	System Decimal Point	Bits
13	Lockout2	Lockout1	Bits
12	Serial Cnfg2	Serial Cnfg1	Bits
11	Options	Filter	Bits
10	Setup	Input Type	Bits
0F	Alarm Cnfg Byte 2	Alarm Cnfg1	Bits
0E	Analog High Byte 3	Analog High Byte 2	2's Complement
0D	Analog High Byte 1	Analog Low Byte 3	2's Complement
0C	Analog Low Byte 2	Analog Low Byte 1	2's Complement
0B	High Read Byte 3	High Read Byte 2	2's Complement
0A	High Read Byte 1	High In Byte 3	2's Complement
09	High In Byte 2	High In Byte 1	2's Complement
08	Low Read Byte 3	Low Read Byte 2	2's Complement
07	Low Read Byte 1	Low In Byte 3	2's Complement
06	Low In Byte 2	Low In Byte 1	2's Complement
05	Offset Byte 3	Offset Byte 2	2's Complement
04	Offset1 (2's Comp)	Scale Factor3 (Sign+DP+Mag)	
03	Scale Factor2	Scale Factor1	Sign+DP+Mag
02	Setpoint2 Byte 3	Setpoint2 Byte 2	2's Complement
01	Setpoint2 Byte 1	Setpoint1 Byte 3	2's Complement
00	Setpoint1 Byte 2	Setpoint1 Byte 1	2's Complement

11. WARRANTY & REPAIR POLICY

Limited Warranty on Products

Any of our products which, under normal operating conditions, proves defective in material or in workmanship within one (1) year from the date of shipment by Transducer Techniques, will be repaired or replaced free of charge provided that you obtain a return material authorization from Transducer Techniques and send the defective product, transportation charges prepaid with notice of the defect, and establish that the product has been properly installed, maintained, and operated within the limits of rated and normal usage. Replacement product will be shipped F.O.B. our plant. The terms of this warranty do not extend to any product or part thereof which, under normal usage, has an inherently shorter useful life than one year. The replacement warranty detailed here is the Buyer's exclusive remedy, and will satisfy all obligations of Transducer Techniques, whether based on contract, negligence, or otherwise. Transducer Techniques is not responsible for any incidental or consequential loss or damage which might result from a failure of any Transducer Techniques' product. This express warranty is made in lieu of any and all other warranties, expressed or implied, including implied warranty of merchantability or fitness for particular purpose. Any unauthorized disassembly or attempt to repair voids this warranty.

Obtaining Service Under Warranty

Advance authorization is required prior to the return to Transducer Techniques. Before returning the item(s), either write to the Repair Department c/o Transducer Techniques, 42480 Rio Nedo, Temecula, CA 92590, or call (951) 719-3965 with: 1) a part number; 2) a serial number for the defective product; 3) a technical description of the defect; 4) a no-charge purchase order number (so products can be returned to you correctly); and, 5) ship to and bill to addresses. Shipment to Transducer Techniques shall be at Buyer's expense, and repaired or replacement items will be shipped F.O.B. our plant in Temecula CA. Non-verified problems or defects may be subject to a $75 evaluation charge. Please return the original calibration data with the unit.

Obtaining Non-Warranty Service

Advance authorization is required prior to the return to Transducer Techniques. Before returning the item(s), either write to the Repair Department c/o Transducer Techniques, 42480 Rio Nedo, Temecula, CA 92590, or call (951) 719-3965 with: 1) a model number; 2) a serial number for the defective product; 3) a technical description of the malfunction; 4) a purchase order number to cover Transducer Techniques' repair cost; and 5) ship to and bill to addresses. After the product is evaluated by Transducer Techniques, we will contact you to provide the estimated repair costs before proceeding. The minimum evaluation charge is $75. Shipment to Transducer Techniques shall be at Buyer's expense, and repaired items will be shipped to you F.O.B. our plant in Temecula, CA. Please return the original calibration data with the unit.

Repair Warranty

All repairs of Transducer Techniques' products are warranted for a period of 90 days from the date of shipment. This warranty applies only to those items which were found defective and repaired; it does not apply to products in which no defect was found and returned as is, or merely re-calibrated. Out of warranty products may not be capable of being returned to the exact original specifications or dimensions.

Load Cells
Force/Torque
Sensors ™

(800) 344-3965

E-mail: tti@ttloadcells.com
www.transducertechniques.com
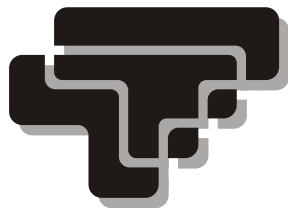
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Temecula, CA 92590